CLAIMS

What is claimed is:

1. A method for creating semiconductor devices, comprising:

providing a photoresist layer on a wafer;

patterning the photoresist layer;

chemically cross-linking polymers in the patterned photoresist layer by exposure to at least one reactive chemical; and

transferring the pattern in the photoresist layer.

2. The method, as recited in claim 1, wherein the chemically cross-linking polymers, comprises exposing the patterned photoresist layer to a reactive gas.

3. The method, as recited in claim 2, wherein the patterning the photoresist layer comprises exposing the photoresist layer with a light that has a wavelength that is less than 248 nm.

4. The method, as recited in claim 2, wherein the patterning the photoresist layer comprises exposing the photoresist layer with a light that has a wavelength no greater than 193 nm.

5. The method, as recited in claim 4, wherein the chemically cross-linking polymers, further comprises heating the wafer.

6. The method, as recited in claim 5, wherein transferring the pattern comprises etching the wafer.

7. The method, as recited in claim 5, wherein the transferring the pattern comprises implanting ions into the wafer.

8. The method, as recited in claim 2, wherein at least the top 10% of volume of the photoresist layer is cross-linked.

9. The method, as recited in claim 2, wherein the chemical cross-linking improves photoresist etch selectivity without shrinkage.

10. The method, as recited in claim 2, wherein the photoresist layer is a photoresist material selected from the group comprising of Poly(methyl methacrylate) derivatives and Cycloolefin Maleic Anhydride derivatives.

11. A method for creating semiconductor devices, comprising:

providing a photoresist layer on a wafer;

patterning the photoresist layer, comprising:

exposing regions of the photoresist layer with a light with a wavelength no greater than 193 nm; and

removing regions of the photoresist layer;

cross-linking polymers in the patterned photoresist layer; and

transferring the pattern in the photoresist layer to the wafer.

12. The method, as recited in claim 11, wherein the photoresist layer is a photoresist material selected from the group comprising of Poly(methyl methacrylate) derivatives and Cycloolefin Maleic Anhydride derivatives.

13. A method for creating semiconductor devices, comprising:

providing a photoresist layer on a wafer;

patterning the photoresist layer;

exposing regions of the photoresist layer with a light with a wavelength no greater than 193 nm; and

removing regions of the photoresist layer;

heating the wafer

chemically cross-linking polymers in the patterned photoresist layer by exposing the patterned photoresist layer to a reactive gas; and

etching the pattern in the photoresist layer into the wafer.

14. A semiconductor device created by the method comprising:

providing a photoresist layer on a wafer;

patterning the photoresist layer;

chemically cross-linking polymers in the patterned photoresist layer by exposure to at least one reactive chemical; and

transferring the pattern in the photoresist layer to the wafer.

15. The semiconductor device, as recited in claim 14, wherein the chemically cross-linking polymers, comprises exposing the patterned photoresist layer to a reactive gas.

16. The semiconductor device, as recited in claim 14, wherein the patterning the photoresist layer comprises exposing the photoresist layer with a light that has a wavelength that is less than 248 nm.

17. A reaction chamber for processing a wafer with a patterned layer of photoresist material, comprising:

a chamber with a central cavity;

a wafer support for supporting the wafer in the central cavity; and

a cross-linking reactive chemical source in fluid contact with the chamber and which provides a reactive chemical which causes cross-linking of the photoresist.

18. The reaction chamber, as recited in claim 17, further comprising:

a wafer heater in thermal contact with the wafer support; and

a device for regulating the pressure in the chamber.

19. The reactor chamber, as recited in claim 18, further comprising a control system, comprising computer readable media, comprising:

computer readable code controlling the device for regulating pressure in the chamber;

computer readable code for instructing the wafer heater to heat the wafer to an operational temperature; and

computer readable code for instructing the reactive chemical source to provide reactive chemical to the chamber cavity to expose the wafer to the reactive chemical.